1,199,036

PATENT SPECIFICATION

DRAWINGS ATTACHED

1,199,036

Date of Application and filing Complete Specification: 24 July, 1967.
No. 19787/68.
Application made in Sweden (No. 12149) on 9 Sept., 1966.
(Divided out of No. 1199035).
Complete Specification Published: 15 July, 1970.

ERRATA

SPECIFICATION No. 1,199,036

Page 3, line 60, *for* "27" *read* "57"
Page 4, line 46, *after* "said" *insert* "press"
Page 4, line 53, *for* "ahe" *read* "are"
THE PATENT OFFICE
13th October 1970

by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to apparatus for continuous drainage of a travelling fibre web, for example, the continuous drainage of a fibre web formed in a board machine.

In the usual board machines, a continuous fibre web is produced by draining a fibre suspension on an endless wire running over one or several kinds of dewatering means, such as e.g. table rolls, drainage strips and suction boxes. A fibre web of board furnish produced in such a machine is often thick and has such a high water content that additional drainage is necessary before it can be subjected, without risk of damage, to pressing by means of e.g. press rolls. Such a fibre web requires a long pressing time for pressing out the water. The disadvantages of pressing between solid rolls are partly that the effective length of the roll press nip is short, and therefore gives a short effective pressing time partly that the press load must be limited, as the water pressed out at the nip will flow in the plane of the web in the opposite direction to the web travel. If the velocity of flow in the web becomes too high, hydraulic forces will cause the web to be wholly or partially broken up mechanically, and the result will be so-called crushing.

It is known in itself that by means of prepressing in a wet press, the water content of fibre web is pressed between the wire on which it was formed and a top wire, in that the two wires are made to form a number of dewatering nips between a series of press rolls arranged in pairs. The pressing time in each one of these nips is short, with large pressure gradients in the plane of the web as a result. Crushing can occur here and impair the quality of the web without necessarily spoiling it completely. Other means of pressing have a nip of fixed shape between press plates or similar that are often enclosed by endless wires or steel belts. In certain cases the shape of the nip is fixed by endless belts provided with smooth or perforated press plates moving in the direction of travel of the wire. The compressive force in these nips of fixed shape is raised to varying magnitude depending on variations in the properties of the web (thickness, quality, etc.). Even a very small increase in basis weight of the web can cause a substantial increase in the pressure gradients, resulting in crushing that is difficult to detect.

In the above-mentioned means, the press plates or the endless belts can be adjustable vertically, so that the fibre web is subjected to a higher compressive force as it is carried forward by the driven wires. In certain cases the top wire can be replaced by a felt.

Earlier known methods and means for drainage by continuous pressing of a travelling fibre web give very unequal results that

[*Price 5s. 0d. (25p)*]

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Index at acceptance: —**D2** A(7A2, 7B2, 7B4, 7B6, 7B12, 7B13, 7B14, 7B15, 7B17, 7B27)

International Classification: —**D 21 f 3/06**

COMPLETE SPECIFICATION

Improvements in or relating to Apparatus for Continuous Pressing of Travelling Fibre Webs

We, AKTIEBOLAGET KARLSTADS MEKANISKA WERKSTAD, a Swedish Company, of 20, Verkstadsgatan, Karlstad, Sweden, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to apparatus for continuous drainage of a travelling fibre web, for example, the continuous drainage of a fibre web formed in a board machine.

In the usual board machines, a continuous fibre web is produced by draining a fibre suspension on an endless wire running over one or several kinds of dewatering means, such as e.g. table rolls, drainage strips and suction boxes. A fibre web of board furnish produced in such a machine is often thick and has such a high water content that additional drainage is necessary before it can be subjected, without risk of damage, to pressing by means of e.g. press rolls. Such a fibre web requires a long pressing time for pressing out the water. The disadvantages of pressing between solid rolls are partly that the effective length of the roll press nip is short, and therefore gives a short effective pressing time partly that the press load must be limited, as the water pressed out at the nip will flow in the plane of the web in the opposite direction to the web travel. If the velocity of flow in the web becomes too high, hydraulic forces will cause the web to be wholly or partially broken up mechanically, and the result will be so-called crushing.

It is known in itself that by means of prepressing in a wet press, the water content of a fibre web can be reduced before it is delivered to conventional pressing means, and several different kinds of device have been used or suggested.

In certain known pre-pressing devices the fibre web is pressed between the wire on which it was formed and a top wire, in that the two wires are made to form a number of dewatering nips between a series of press rolls arranged in pairs. The pressing time in each one of these nips is short, with large pressure gradients in the plane of the web as a result. Crushing can occur here and impair the quality of the web without necessarily spoiling it completely. Other means of pressing have a nip of fixed shape between press plates or similar that are often enclosed by endless wires or steel belts. In certain cases the shape of the nip is fixed by endless belts provided with smooth or perforated press plates moving in the direction of travel of the wire. The compressive force in these nips of fixed shape is raised to varying magnitude depending on variations in the properties of the web (thickness, quality, etc.). Even a very small increase in basis weight of the web can cause a substantial increase in the pressure gradients, resulting in crushing that is difficult to detect.

In the above-mentioned means, the press plates or the endless belts can be adjustable vertically, so that the fibre web is subjected to a higher compressive force as it is carried forward by the driven wires. In certain cases the top wire can be replaced by a felt.

Earlier known methods and means for drainage by continuous pressing of a travelling fibre web give very unequal results that

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are difficult to control quickly. Many of the means are inefficient or complicated.

The magnitude and distribution of the compression pressure in a press nip are usually illustrated by a pressure-distribution curve. For a satisfactory pressing operation, it is desirable that the requisite compression pressure is attained without the pressure gradient reaching such values that the web is damaged. For different cases of pressing, it can be established tolerably well how the pressure-distribution curve should appear if it is to represent a favourable pressing operation. When pressing a travelling fibre web in a press nip between two press plates, arranged in the direction of travel of the web and one of which is fixed and parallel to the direction of travel of the web and the other is movable in relation to the first as regards angle and distance, the appearance of the pressure-distribution curve will be determined essentially by a number of factors, such as basis weight, moisture content, dynamic compression properties and velocity of the web, and the profile of the movable press plate, the vertical angular position of the movable press plate relative to the direction of travel of the web and the distance of the movable press plate from the fixed press plate. The same factors have the same fundamental importance in the case when both the press plates are movable in relation to each other as regards angle and distance. Of the said factors, only the angular position and the distance can be controlled in conjunction with the actual pressing operation. If external, variable forces are caused to actuate the movable press plate, its angular position and distance can be controlled, and the appearance of the pressure-distribution curve is thereby altered within certain limits. If any of the web properties are altered during pressing, this will cause an alteration of the appearance of the pressure-distribution curve. By suitable control of angular position and distance of the movable press plate, however, such changes of the pressure-distribution curve could be counteracted, so that it retains an essentially unaltered appearance. In a press according to our invention, both angular position and distance of the movable press plate can be controlled within wide limits.

According to the present invention there is provided a continuous press for the drainage of a travelling fibre web, for example, a fibre web formed in a board machine, comprising a press nip between a bottom press plate along which at least one bottom wire is arranged to travel and a top press plate along which at least one top wire or felt is arranged to travel, said press plates not being arranged to travel with the wires or wire and felt, at least one of said press plates being perforated and at least one of said press plates being movable in relation to the other with respect to angle and distance, each press plate that is movable in relation to the other being pivotally connected to one or more levers, that are pivotally mounted in a stationary frame, and said lever or levers being also connected to the said frame by means of one or more pressure devices.

As the shape of the press nip is variable, and the nip pressure can be controlled to a great extent, both in respect of its total magnitude and its distribution, the risk of crushing will be reduced. The press plates are considerably extended in the direction of travel of the web, and the pressing time will therefore be long.

The water pressed out will flow through the web, principally at right angles to the plane of this, and out through the perforated plate or plates, wherefore the compression pressure can be kept high without a risk of crushing. Since the press plates do not travel with the web and wires or wire and felt, the pressed-out water will remain in the pressing zone and can be conducted away from there. No rewetting of the web by the stationary press plates will occur, as with travelling press plates. The dryness of a web will be considerably higher after pressing in a means according to the invention than it would be after pressing in earlier known pressing devices.

The invention will now be further described, by way of example, with reference to the accompanying drawings in which:—

Fig. 1 shows schematically a board machine, as seen from the side, at right angles to the machine direction.

Fig. 2 shows a press constructed in accordance with the present invention, as seen from the side, at right angles to the machine direction.

Fig. 3 shows part of a perforated bottom press plate, as seen from above. An arrow indicates the machine direction.

Fig. 4 shows a cross section, taken along the line IV—IV in Fig. 3, of part of a press plate.

Fig. 1 shows a board machine fitted with a headbox 1 with deckle boards 3 arranged to spread a suspension of board furnish over an endless bottom wire 5. The bottom wire 5 is supported by three endless power fabrics 7 arranged to run over guide rolls 9 and stretch rolls 11. The bottom wire 5 is arranged to run in a loop over the power fabrics 7, round a bottom roll 13 in a couch press 15 and then over guide rolls 17, stretch rolls 19 and a wire regulating device 21. Suction boxes 23 are arranged in the loops of the power fabrics 7. Other kinds of drainage devices, e.g. table rolls and drainage strips, can also be arranged in suitable positions in the wire loops. An endless top wire 25 is arranged to run in a loop round a top roll 27

in the couch press 15 and then round a guide roll 29 and a stretch roll 31. The top wire 25 can be replaced by a felt. A press 33, constructed according to the present invention is located ahead of the couch press 15.

Fig. 2 shows the press 33 in detail, comprising a bottom, perforated press plate 35 and a top, perforated press plate 37. Both the press plates 35 and 37 are shown flat, but they could even be curved, in order to obtain a desired pressure-distribution curve when pressing. The bottom press plate 35 is rigidly connected to a stationary frame 39. The top press plate 37 is pivotally mounted about two pins 41 in two parallel levers 43, (only one pin and one lever being visible in Figs. 1 and 2 since these Figs. are side elevational views and the pins and levers are side-by-side), so that the axis of rotation of plate 37 is horizontal and at right angles to the direction of travel of the wires 5, 7 and 25. In relation to the geometrical centre line of press plate 37 across the direction of travel of the wires 5, 7 and 25, the axis of rotation of press plate 37 is located beyond the centre line, considered in the direction of travel of the wires 5, 7 and 25. Each lever 43 is pivotally mounted by a pin 45 in the frame 39. Two pneumatic pressure devices 47 (only one pneumatic pressure device is visible in Fig. 2 due to Fig. 2 being a side elevational view) are arranged between the rear part of the top plate 37; considered in the direction of travel of the wires 5, 7, 25, and the two levers 43. The frame 39 is provided with two hydraulic pressure devices 49 (only one hydraulic pressure device being visible due to Fig. 2 being a side elevation), each of which is fitted with a piston rod 51. Both the piston rods 51 are pivotally connected to the levers 43 by means of pins 53. The pressure devices 47 and 49 can be alternatively pneumatic, hydraulic or mechanical. Both the press plates 35 and 37, together with power fabric 7, bottom wire 5 and top wire 25, from a press nip 55 for a fibre web 57, formed and conveyed on the bottom wire 5. Press plates 35 and 37 are perforated and provided with gutters 59, to carry off water, that extend straight across the machine direction and therefore discharge outside the wires 5, 7 and 25.

Figs. 3 and 4 show how the bottom press plate 35 is provided with a large number of holes 61, substantially at right angles to the surface of the plate 35 and arranged in a suitable pattern. It is essential that the holes 61 are large enough and pitched closely enough so that the total resistance to flow of the water of the fibre web 27 through the web 57, the wires 5 and 7 and out through the holes 61 is lower essentially at right angles to the plane of the web 57 than in any other direction. In order to facilitate the movement of water to the holes 61, the surface of the press plate 35 facing the wire 7 is provided with grooves 63 that interconnect the holes 61.

The board machine described in the foregoing paragraphs operates fundamentally in the following manner: For the production of a board, a suspension of board furnish is spread, by means of the headbox 1, over the bottom wire 5, which is made to travel in the machine direction. The suspension is drained through the bottom wire 5 and forms a continuous web of fibres 57. The fibre web 57 is carried on the bottom wire 5 through the press 33 and the couch press 15, whereafter it is taken off the bottom wire 5 for further treatment. In the press 33 the fibre web 57 is made to run, together with the bottom wire 5, one of the power fabrics 7 and the top wire 25, through the press nip 55 between the two press plates 35 and 37. Compressive forces of adjustable magnitude, for controlling the movable press plate 37, are produced by supplying pressure medium to the pressure devices 47 and 49 from suitable sources. The forces from pressure devices 47 and 49 produce compression pressure and a turning moment on the press plate 37 in a manner that will be described in what follows. The compressive force from the pressure device 49 is transmitted by the piston rod 51 and the pin 53 to the lever 43, and gives lever 43 a turning moment about the pin 45. This turning moment is counteracted by a second turning moment on lever 43 about the pin 45 due to a restoring force from the press plate 37 directed through the pin 41, and a restoring force from the pressure device 47. A definite value of the restoring force through the pin 41 will correspond to definite values of the compressive forces from the pressure devices 47 and 49, when the lever 43 is in equilibrium. By controlling the forces from pressure devices 47 and 49, each of the restoring forces directed through pressure device 47 and pin 41 is set at a definite value. These restoring forces are balanced by external forces on the press plate 37, and the sum of these determines the total magnitude of the compression pressure of press plate 33 on the fibre web 57. The magnitude ratio of the external forces determines the position of their resultant between the pin 41 and the pressure device 47 on the rear edge of the press plate 37. The resultant of the external forces produces a turning moment on the press plate 37 about the pin 41. This turning moment causes the press plate 37 to assume an angular position in which it balances the turning moment that the restoring forces from fibe web 57 exert on the press plate 37. Angular position and distance to press plate 35 of press plate 37 are determined by the balance between the adjustable compressive forces originating from the pressure devices 47 and 49, and the

restoring forces from the fibre web 57 in the press nip 55 on press plate 37. By control of the angular position and distance to press plate 35 of press plate 37, the magnitude of the total compression pressure in the press nip 55 during continuous pressing is made to be essentially constant, and the pressure-distribution curve to retain an essentially unchanged appearance.

In our co-pending Application No. 33901/67 (Serial No. 1,199,035) we have claimed a method for continuous drainage of a travelling fibre web, for example, a fibre web formed in a board machine, comprising pressing the web in a press nip between a bottom press plate along which at least one bottom wire is travelling and a top press plate along which at least one top wire or felt is travelling, said press plates not travelling with the web and wires or wire and felt, at least one of said press plates being perforated and at least one of said press plates being movable in relation to the other with respect to angle and distance by adjustable forces, the resultant of which forces is applied to said at least one press plate at a position downstream with respect to the direction of travel of the web from the transverse centreline of said at least one press plate, said adjustable forces being effective to exert in the press nip a pressure on the web of which the total magnitude over the area of the press plates is substantially constant and the distribution of pressure in the direction of movement of the web yields a distribution curve of substantially constant shape, regardless of transient variations in the thickness and drainage properties of the web.

WHAT WE CLAIM IS:—

1. A continuous press for the drainage of a travelling fibre web, for example, a fibre web formed in a board machine, comprising a press nip between a bottom press plate along which at least one bottom wire is arranged to travel and a top press plate along which at least one top wire or felt is arranged to travel, said plates not being arranged to travel with the wires or wire and felt, at least one of said press plates being perforated and at least one of said press plates being movable in relation to the other with respect to angle and distance, each press plate that is movable in relation to the other being pivotally connected to one or more levers, that ahe pivotally mounted in a stationary frame, and said lever or levers being also connected to the said frame by means of one or more pressure devices.

2. A continuous press as claimed in claim 1, in which the movable press plate is pivotally connected to one or more levers at a position downstream with respect to the direction of travel of the web from the transverse centreline of said movable plate.

3. A continuous press as claimed in claim 1 or 2, in which the said movable press plate is mounted on a pair of levers mounted for pivoted movement on the stationary frame about a first pivot axis disposed across the direction of movement of the web, and the movable press plate is mounted on said pair of levers for pivotal movement about a second pivot axis parallel to the first pivot axis; the pressure devices for urging said movable press plate toward the other press plate including a set of hydraulic pressure devices coupled between said levers and said frame.

4. A continuous press as claimed in claim 3 further including pneumatic pressure means acting between said movable press plate and said levers.

5. A continuous press as claimed in claim 1 or 2 in which at least one press plate, which is movable in relation to the other, is connected to one or more of said levers by means of one or more pressure devices.

6. A continuous press as claimed in claim 1 or 2 in which at least one perforated press plate is provided with one or more gutters straight across the direction of travel of the bottom wire to carry off water.

7. A continuous press as claimed in claim 1 or 2 in which at least one perforated press plate is provided in the surface facing the press nip, with grooves, which interconnect the perforation holes.

8. A continuous press for the drainage of a travelling fibre web, constructed and arranged and adapted to be operated substantially as hereinbefore particularly described with reference to and as illustrated in the accompanying drawings.

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1199036 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

Fig.1

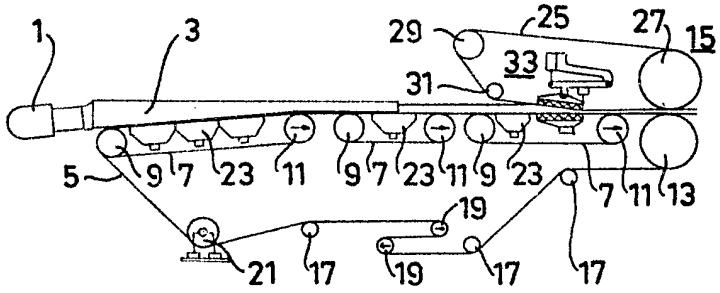

Fig. 2

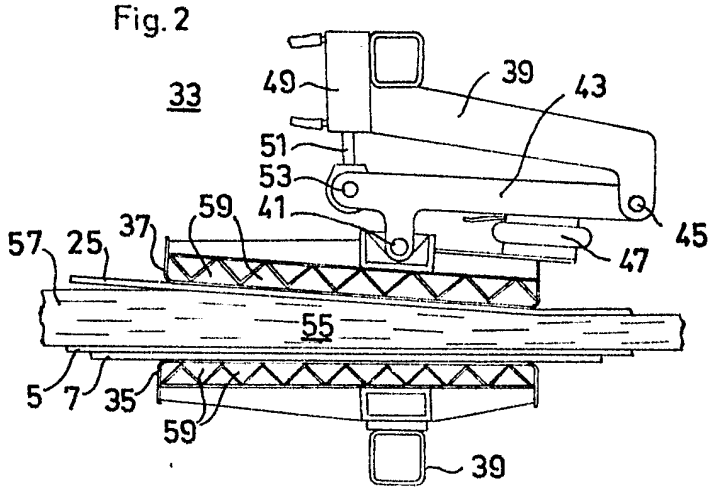

Fig.3

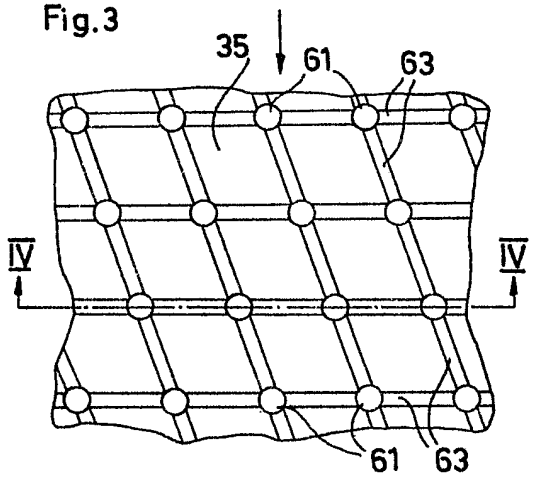

Fig.4